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**OCCUPANT  
RESTRAINTS  
and  
THE HUMAN  
COLLISION**

Canada



# OCCUPANT RESTRAINTS

*and*

## THE HUMAN COLLISION

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**For more information on  
occupant restraints,  
telephone Transport  
Canada's toll free number**

**1-800-333-0371**

(For Ottawa/Hull  
area callers,  
telephone 998-8616)

# OCCUPANT RESTRAINTS

*and*

## THE HUMAN COLLISION

### *The Facts*

Each year on average there are more than 650,000 crashes, 170,000 people injured and 3,200 killed.

Since 1950, a staggering 180,000 Canadians have died on our roads.

### *Saving Lives*

Increasing the use of occupant restraints by all Canadians is the most effective way of reducing the death toll on our highways.

Using seat belts or child restraints will reduce the likelihood of being injured or killed in a traffic crash by 55 and 75 per cent respectively.

***Buckle up . . . it could save your life!***

## LIFE SPACE

The occupant space of your vehicle is like a protective box or cocoon. More and more this **life space** is designed and constructed to withstand the force of most impacts.

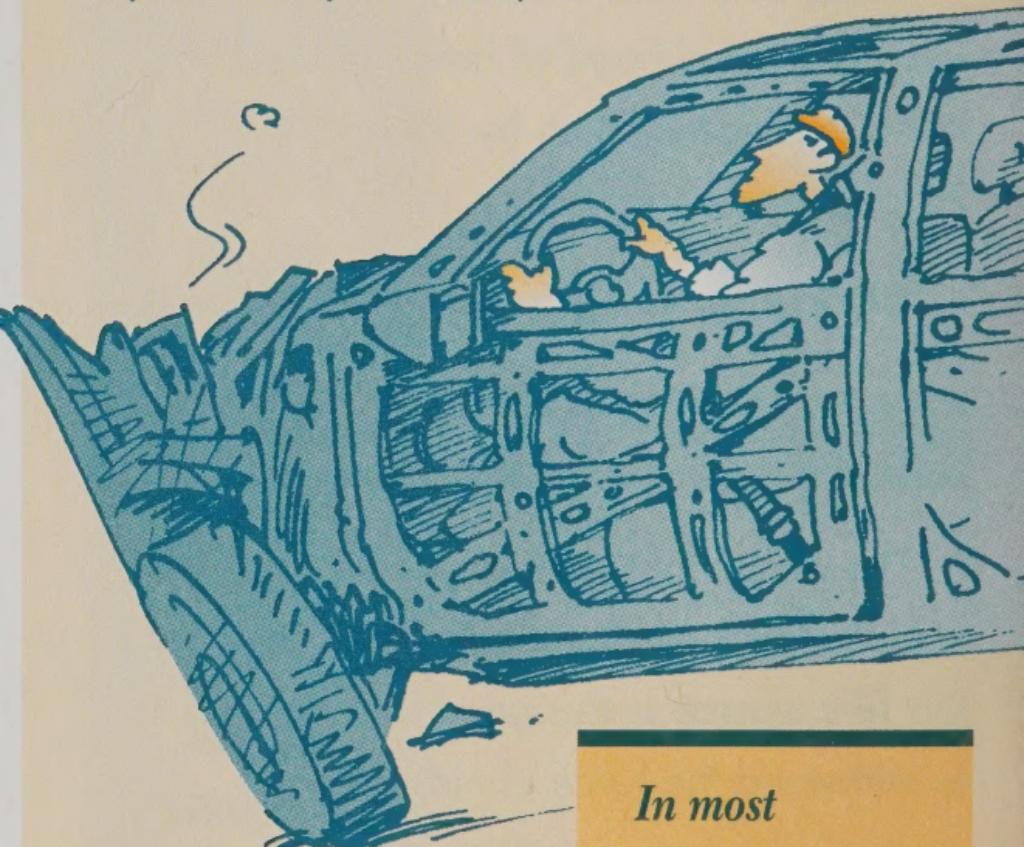
The **life space** is a safety system, the components of which are due in part to the safety standards and regulations developed by Transport Canada.

For example, air bags, energy absorbing steering columns, padded dashboards, reinforced beams and doors, stronger seats and anchorages, head restraints, etc., have all transformed today's automobile, light truck and van into a safer vehicle.

At the moment of a collision, these safety devices all work together to preserve the **life space** of the occupants.

In most collisions, the passenger compartment stays intact; injuries and fatalities occur when the unbelted occupant is thrown about inside or is ejected from the vehicle.

As such, your **life space** can only be safe if you wear your occupant restraint.



*In most collisions, the passenger compartment stays intact.*

# THE COLLISION

Motor vehicle collisions have been studied extensively over the years in an effort to reduce fatalities and injuries.

Through the use of ultra slow-motion film and precision instruments, these studies have provided much understanding of what happens to the vehicle and to the occupants during a crash.

## ***The Vehicle Collision***

A vehicle will stop abruptly when it hits a solid object.

At an impact speed of 48 km/h, the front of the vehicle crushes about 60 cm and comes to a complete stop within one tenth of a second.

The crushing of the front end serves as a cushion for the rest of the vehicle and helps absorb the shock of the collision. The passenger compartment (**life space**) comes to a more gradual stop than the front and usually remains undamaged.

## ***The Human Collision***

There are really two kinds of collisions within an accident.

The first is the vehicle that hits something, buckles and bends, and comes to a stop.

The second and more important collision is the **human collision**, which occurs when

people not wearing seat belts are thrown about inside the **life space** of the vehicle.

It is the **human collision** that causes injury and death.

There are three principal ways of being injured or killed in a collision:

- You hit something.
- Something hits you.
- You are ejected.

*At 48 km/h,  
a collision would be  
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a third floor  
window to the hard  
ground below.*



In each case, the force of the collision is exerted against the vital areas of the body such as the head, chest and abdomen. At 48 km/h, such a collision would be equal to a fall from a third floor window to the hard ground below.

During a collision, the occupants move like projectiles toward the point of impact.

### **Types of Collisions**

There are four common types of collisions:

- Frontal collision
- Side impact
- Rear collision
- Rollover

### **Frontal Collisions**

More than one third of all motor vehicle crashes are frontal collisions.

During these crashes, the front end will collapse, absorbing some of the crash energy. Meanwhile, inside the **life space**, all objects and unrestrained occupants move towards the point of impact.

The unbelted driver will likely hit the steering wheel, while the unrestrained passenger in the front seat will hit the windshield and dashboard. Passengers not using restraints in the rear seat will collide with the front occupants or crush them between the seat and the dashboard.

At high speeds, a frontal collision can eject the unbelted occupants through the windshield.

A seat belt or child restraint will prevent or minimize these **human collisions**.



### **Side Impacts**

More than 40 per cent of all accidents are side impact collisions, and most occur at traffic intersections.

Unlike in the frontal collision, the vehicle provides little structure to absorb the energy of a crash. As such, the side of the vehicle can buckle, reducing the occupant's **life space**.

All unrestrained occupants will move to the side of the impact, often hitting one another with the full force of the collision.

Drivers wearing seat belts are more likely to maintain control of their vehicles in a crash situation and so avoid another collision at an intersection.

Although most fatalities are the result of side impacts, seat belts and tethered child restraints can still reduce the perilous nature of these collisions by limiting the severity of injuries and risks of death.

## **Rear Collisions**

Upon impact in a rear collision, the occupants are thrust against the back of their seats.

Head restraints (head rests to most drivers) play a more major role in minimizing neck injuries to the occupants in a rear collision. Seat belts prevent ejections.

Although head restraints provide a certain degree of comfort, they were installed as another measure of safety within the **life space** of the vehicle.

If your vehicle is equipped with adjustable head restraints, make sure they are set properly. The head restraint should never be positioned lower than the ear.

In a rear collision, unrestrained occupants rebound towards the front of the vehicle, causing injuries in the same way that would occur in a frontal collision.

If your seat belts are fastened and your head restraint is adjusted properly, the risk of the **human collision** is reduced.

## **Rollovers**

For the unrestrained occupant, the rollover is the most dangerous of collisions.

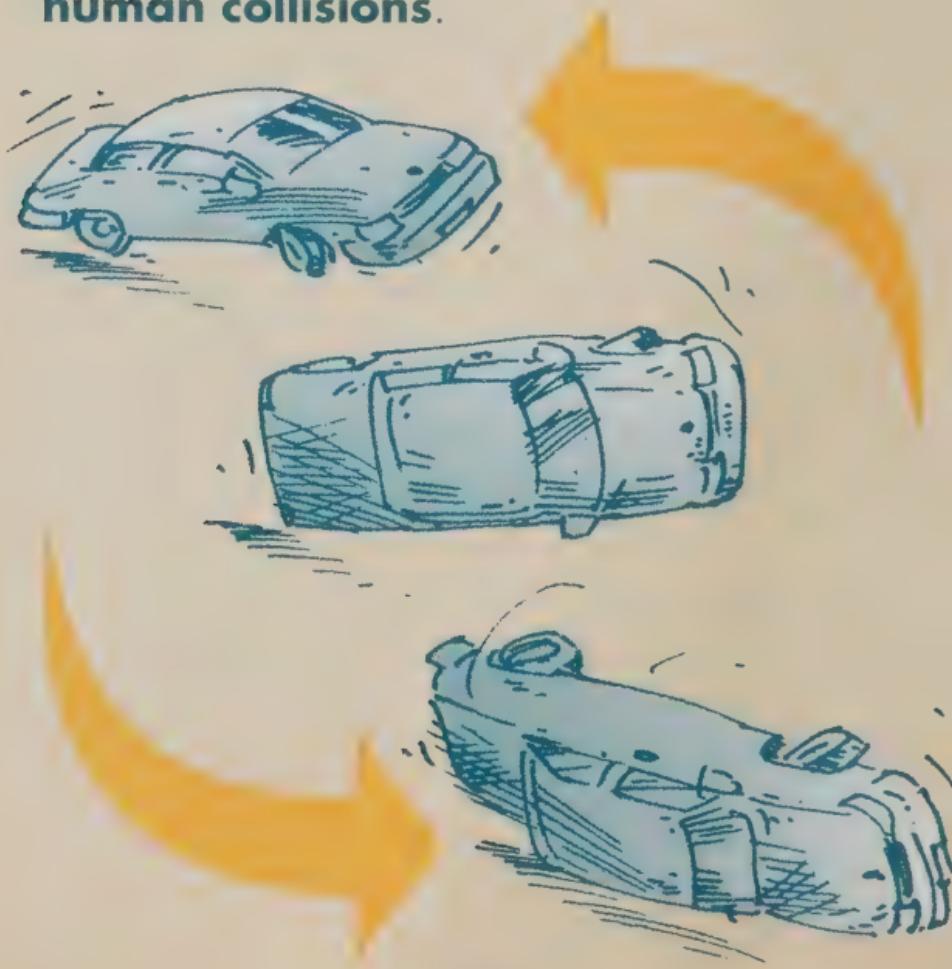
Although rollovers account for only 13 per cent of all accidents, they account for more than one out of every five persons killed in traffic collisions.

A rollover can happen at modest speeds. Ejection can often occur while the vehicle is flipping over and tossing the unbelted occupants about.

About 50 per cent of all passengers not using restraints suffer extensive injuries inside the vehicle before they are ejected.

In rollovers, seat belts and child restraints are key in reducing serious or fatal injuries.

Rollovers are the most dangerous of **human collisions**.



# OCCUPANT RESTRAINTS/ SEAT BELTS

The combination lap and shoulder belt is your personal emergency brake that will reduce the potential of injury or death.

It is the safety device that will help prevent the **human collision** in the **life space** of your vehicle.

Seat belts work because they hold you securely in place and distribute the force of an impact to the more solid areas of the body.

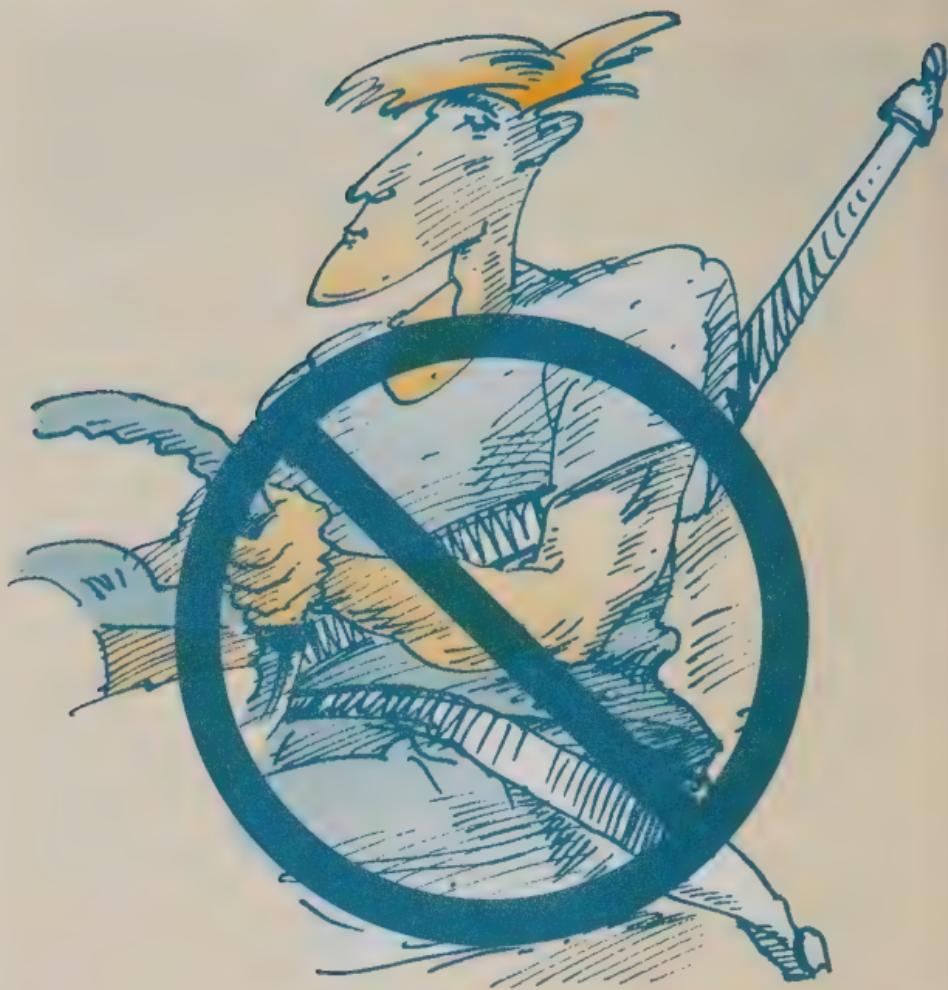
The lap belt will help prevent the occupant from being thrown out of the vehicle, while allowing the lower body to absorb much of the force of the collision.

The shoulder belt will provide extra protection in preventing injuries to the head and face. It helps avoid these injuries by restraining the upper part of the body.

## **Proper Use**

The lap and shoulder belt is only effective if it is properly adjusted.

The lap portion of the seat belt must be firmly adjusted as low as possible on the hips and not over the abdomen. The shoulder belt must pass over the shoulder and fit snugly over the chest.



*The shoulder belt should never be worn under the arm.*

The shoulder belt should never be worn under the arm. On impact, the pressure of the belt over the heart could cause a ruptured aorta.

### ***Protection of the Unborn Child***

The best way to protect the unborn child is to protect the mother.

Pregnant women should take special care to adjust their seat belts. Sitting upright as possible, the lap belt should be worn under the abdomen and as low over the hips as possible.

# CHILD RESTRAINTS

Children are protected by seats specifically designed for them.

## **Child restraints are the law.**

If they are installed and used correctly, they could save your child's life. Before you install your child's seat, read the manufacturer's instructions and label carefully.

Like the seat belt, the restraint prevents a child from being thrown about in a vehicle.

There are four types of child restraints manufactured.

Rear-facing infant carriers are for children up to nine kg (20 lb.). A combination seat can be used for infants as a rear-facing carrier and for toddlers between nine kg (20 lb.) and 22 kg (48 lb.) as a front-facing seat. Booster cushions, designed for children who have outgrown their early restraints, help to position the adult seat belt on the child for an improved fit. Integrated child seats are built into the vehicle seat bench.

### ***Infant Carriers***

The seat should always be installed so it faces the back of the vehicle.

This is done because the force of a sudden stop or collision is spread evenly over the infant's body. If the baby is thrown

forward, the undeveloped muscles of the neck and back would not be able to withstand these pressures.

The infant is restrained by a harness, and the carrier is anchored by the vehicle's seat belt.

If you are travelling alone, you might feel more comfortable placing the infant carrier in the passenger seat beside you. This allows you to check on the child without taking your attention off the road.

## Warning

- **Never place an infant carrier in the front seat if the vehicle is equipped with a passenger-side air bag because the infant could be seriously injured when the bag deploys.**
- **Never ride in a vehicle with a baby or a small child on your lap. It is dangerous. Even at slow speeds, a child can be propelled against the dashboard or windshield with a force several times greater than his or her body weight. Studies show that it is impossible to hold on to a child even when you are wearing a seat belt.**

## **Combination seats (Infants and Toddlers)**

When the combination seat is used for an infant up to 9 kg (20 lb.), the seat faces the rear of the vehicle and the baby is held in position by the carrier's harness system. The seat is secured by the vehicle's seat belt.

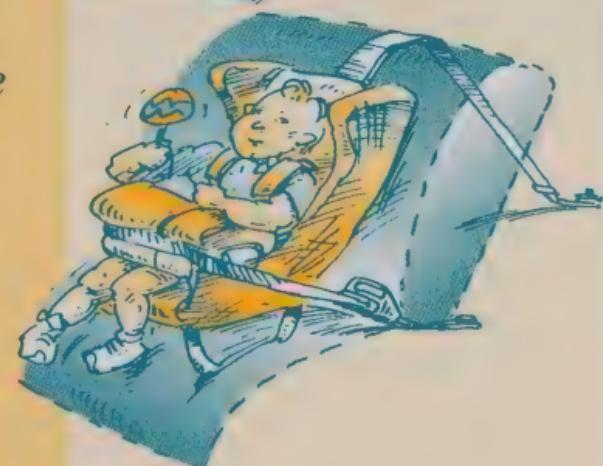
Toddlers weighing between nine kg (20 lb.) and 22 kg (48 lb.) should sit in the rear of the vehicle in a front-facing position.

The child is placed in this position because he or she has developed sufficient muscle control to withstand the forward forces of a sudden stop.

A child restraint is secured by the seat belt and by a **tether strap** fastened by a bolt to the frame of the vehicle. Follow the manufacturer's installation instructions.

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*A child restraint is secured by the seat belt and by a tether strap fastened by a bolt to the frame of the vehicle when the seat faces the front of the vehicle.*



The installation of the **tether strap** is an integral part of the child restraint. A **tether strap** limits the forward and sideways movement of the seat.

Children weighing more than 22 kg (48 lb.) have outgrown their toddler seats. (See manufacturers' instructions for weight restrictions.)

### ***Booster Cushions/Seats***

Before your child is ready to step up to a seat belt, a booster cushion or seat may be used.

Booster cushions, which are for children over 18 kg (40 lb.), give the extra height needed to adjust their seat belt properly over the hips. They are secured by the vehicle seat belt system.

A child has outgrown the booster seat when his or her head is no longer protected by the vehicle seat or head restraint.

### ***Integrated (Built-in) Child Seats***

Some vehicles have child restraint systems built into the vehicle seat bench. As such, integrated child seats don't require tether straps.

Two types of integrated child seats are available. One is a forward-facing seat for toddlers between nine kg (20 lb.) and 22 kg (48 lb.). The other is a booster cushion for children who have outgrown their toddler seats. Some systems combine the toddler seat and the booster cushion.

- When you buy a vehicle with an integrated child restraint, make sure that the seat option meets your needs. Don't use the child restraint system beyond what it was intended to do. If you have a newborn, an integrated child restraint system will not satisfy your initial requirements. You will still have to purchase an infant carrier and/or another child restraint system. A booster cushion may still be required after the child has outgrown the integrated system, depending upon the restraint designed by the vehicle manufacturer. Read the instructions carefully.
- All child restraints sold in Canada must indicate on a label that the product conforms to the Canadian Motor Vehicle Safety Standards of Transport Canada.

## Air Bags

Air bags are designed to supplement the protection provided by seat belts. They are not meant to take their place.



*You should always wear your seat belt because air bags do not stop you from being thrown out of a vehicle.*

These inflatable crash devices only offer protection in frontal collisions. They do not prevent injury or death in rollovers, or side and rear accidents.

You should always wear your seat belt because air bags **do not stop** you from being thrown out of a vehicle.

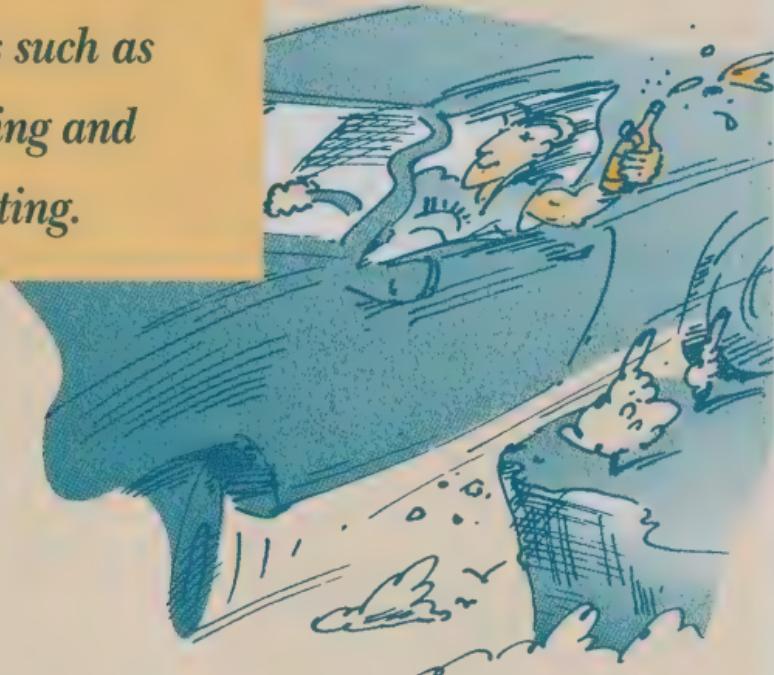
## HIGH RISK DRIVERS

As the use of seat belts increases, research shows that those not wearing the restraints are **high risk drivers**.

Roadside surveys have consistently shown a correlation between the level of alcohol impairment and the non-use of seat belts. As the blood alcohol levels of drivers go up, the use of seat belts goes down.

During a recent **Selective Traffic Enforcement Program (STEP)** in a major metropolitan centre, police conducted a seat

*A profile of high risk drivers will show that they drink and drive and don't wear seat belts; they also exhibit reckless driving habits such as speeding and tailgating.*



belt survey of patrons arriving and leaving a local tavern. They found that the seat belt usage rate of patrons was almost 25 per cent below the average.

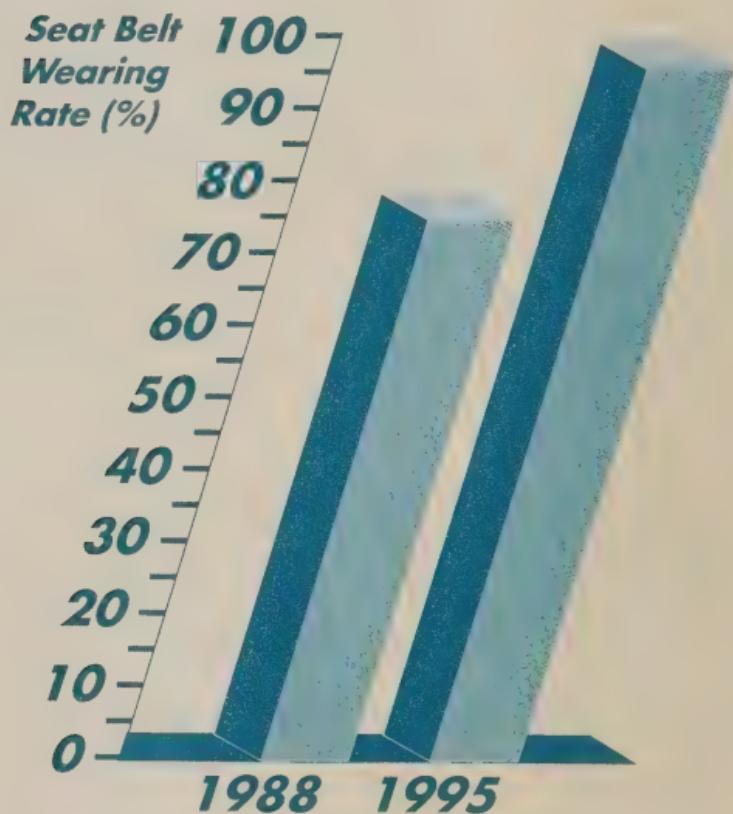
While a profile of most **high risk drivers** will show that they drink and drive and don't wear seat belts, they also exhibit reckless driving habits such as speeding and tailgating.

This group of drivers, which represents only a small percentage of the driving population, accounts for a significant number of all road fatalities.

# NATIONAL OCCUPANT RESTRAINT PROGRAM (NORP)

**NORP** was created in 1988 when Canada's top road safety experts recognized that increasing the use of occupant restraints was the most effective way of reducing the number of injuries and fatalities on our highways. At the time, the seat belt wearing rate was 75 per cent.

In 1989, the federal and provincial ministers of transport set a goal of achieving a seat belt wearing rate of 95 per cent by 1995.



In response to the ministerial commitment, the Canadian Council of Motor Transport Administrators prepared an implementation plan and resource requirements to achieve the objective.

The plan included a combined program of law enforcement of provincial seat belt legislation and public education at both the federal and provincial levels of government.

Achieving a 95 per cent seat belt wearing rate would result in annual savings of over 500 lives and 34,000 fewer injuries on our roads.

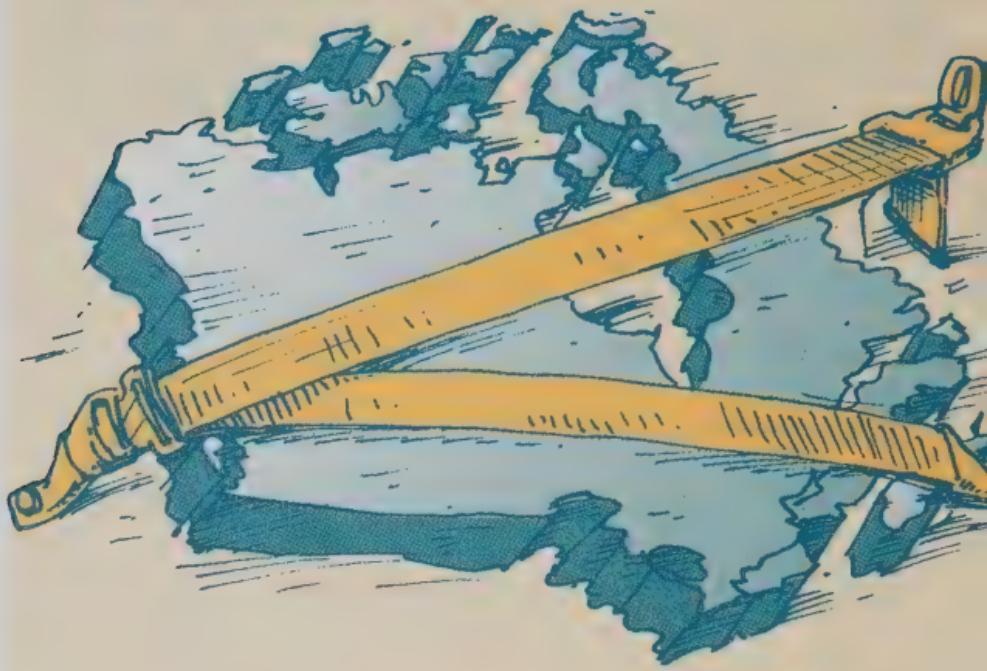
Transport Canada supports NORP by advancing better designs and use of occupant restraint systems through the development of more effective safety standards.

In partnership with the Canadian Automobile Association (CAA), Transport Canada promotes the proper use of child restraints.

As well, Transport Canada has a standards enforcement program so that when safety problems with child restraints are identified, timely information can be disseminated to consumers through the CAA's network of 110 offices across Canada.

Transport Canada also conducts extensive seat belt surveys.

# SEAT BELT LEGISLATION



In 1976, Ontario was the first province to require the use of seat belts.

Other provinces quickly followed Ontario's example. By 1988, seat belt legislation stretched from sea to sea.

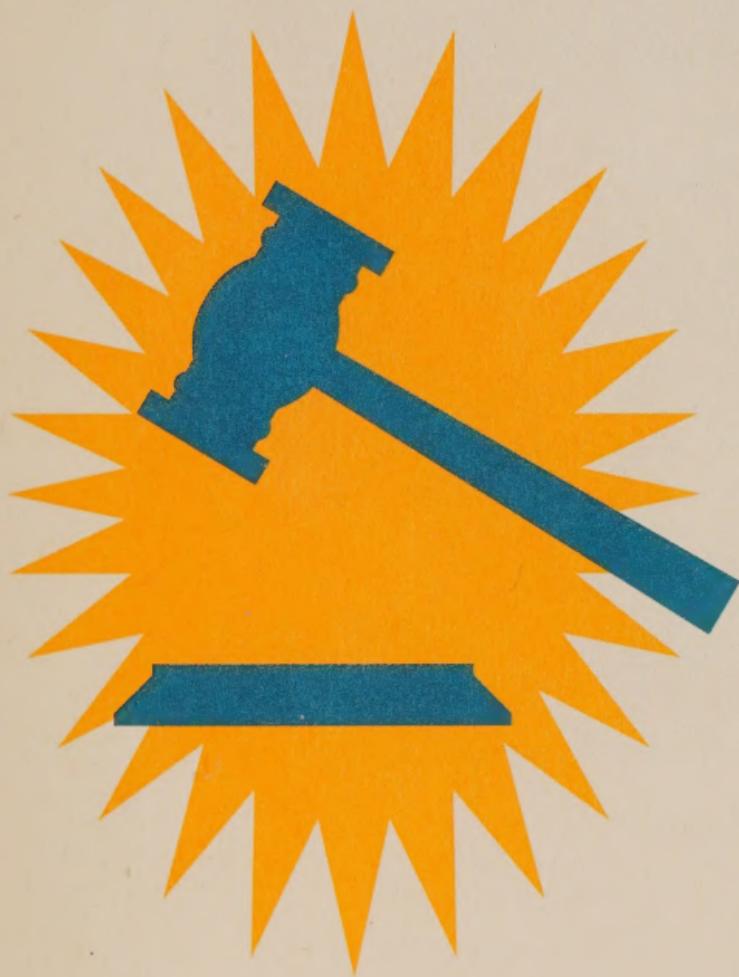
In recent years, seat belt legislation was challenged by individual citizens in Alberta, Prince Edward Island, New Brunswick and Manitoba under the 1982 *Charter of Rights and Freedoms*.

The legislation was contested on the grounds that belts could cause injury and death in and of themselves.

While it was acknowledged that seat belts could cause some incidental injuries, the requirement to use occupant restraints did not contravene the Charter because overall, they did reduce significantly the potential for serious injury and death in a motor vehicle accident.

The only temporarily successful challenge to seat belt legislation took place in Alberta. The statute was overturned in 1988. While the decision was under appeal, the seat belt wearing rate in the province dropped by almost 40 per cent. The law was upheld on appeal and seat belt use not only returned to former levels, but increased by more than five per cent.

## **Buckle up. . . it's the law!**





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